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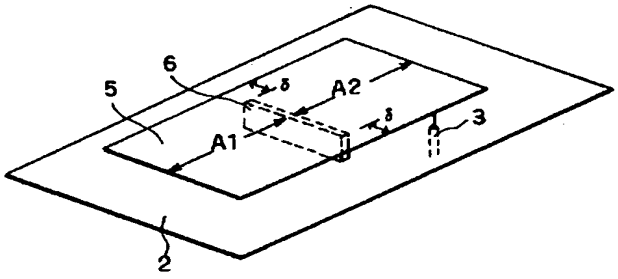
(54)【発明の名称】　平面アンテナ

(57)【要約】

【課題】１つの接地導体板２の上に短絡垂直平板によって平行に放射導体板１が固定された板状逆Ｆアンテナの帯域幅を広くする。

【解決手段】接地導体板２に対向させて平行に放射導体板５を設け、その間を短絡する短絡垂直平板６を放射導体板５の中央より偏った位置に設け、短絡垂直平板６の長さを放射導体板５の幅より２×δだけ短くした。δを実験的に求めて、放射導体板５の給電側の自己共振周波数と、反対側の自己共振周波数の２つの共振周波数によって複同調共振を起こさせることにより帯域幅を広くした。



【特許請求の範囲】
【請求項１】　接地導体板と、該接地導体板に対向して平行に配置された放射導体板と、該放射導体板と前記接地導体板とを短絡固定する短絡垂直平板と、前記放射導体板の側縁部の所定の位置に給電する給電ケーブルとから構成された平板逆Ｆ状の平面アンテナにおいて、
前記放射導体板は、長さ方向の中心より一方に片寄って前記短絡垂直平板で固定され、その一方の側縁部から給電され、
前記短絡垂直平板は、前記放射導体板の幅より短い長さで構成され、
前記放射導体板の固定位置と前記短絡垂直平板の長さを変えることによって、アンテナの所要帯域幅を広く設定したことを特徴とする平面アンテナ。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、携帯電話端末機や、地下街，ビル内の室内に設置される小形中継増幅装置等に搭載される平面アンテナに関し、特に、板状逆Ｆアンテナの改良に関するものである。
【０００２】
【従来の技術】近年、携帯電話は、セルラー電話等のサービスエリアの拡大と、装置の低価格化、通話コストの低減に伴い急速に普及されるようになってきた。そして、人々が多勢通行し生活の場として利用しているにもかかわらず、基地局からの電波が届かない地下街，デパート，オフィスなどの不感地帯のサービスを拡充するため、室内用の小形中継増幅装置が益々求められるようになった。
【０００３】このような室内設置用中継増幅装置に装備されるアンテナは、例えば、ダイポールアンテナのような外部アンテナを使用したものと、室内の美観を損なわないような内部アンテナを使用したものとがある。装置のケース内に取り付ける内部アンテナは、一般的には板状逆Ｆアンテナと呼ばれる平面アンテナが使用されている。このアンテナはマイクロストリップ形逆Ｆアンテナとも呼ばれている。
【０００４】図５は従来の逆Ｆ形平面アンテナの構造を示す斜視図である。この従来の平面アンテナは、接地導体板２と放射導体板１と、整合をとるために放射導体板１の折り曲げたショートスタブ（短絡垂直平板）の位置から所定の距離だけ離した点を給電点として給電する給電ケーブル３とから構成された単共振または単同調板状逆Ｆアンテナである。図６は図５に示した従来の逆Ｆ形平面アンテナの反射特性例図であり、反射量が、所定の電圧定在波比（ＶＳＷＲ）が２以下を満足する－１０ｄＢ以下で使用できる比較帯幅は３．０%である。
【０００５】しかし、例えば、８５０ＭＨｚ帯の携帯電話システムの送受信周波数差は約４５ＭＨｚ（約５．３%）あるため、上記のアンテナを１個で送受信共用するには問題がある。
【０００６】これまで、この比帯域幅の問題を解決すべく様々な工夫がされてきた。例えば図７に示すように、放射導体板１だけではなく、共振周波数が僅かに異なる無給電導体板１’を積み上げて２段にしたものや、図８，図９に示すように、放射導体板１から若干距離はなれたところに平行、或いは対向して無給電導体板４を並べたものがある。これらはアンテナ放射導体板１と無給電導体板４が結合することにより、両方の導体板が放射素子として機能しており、それぞれの共振周波数帯の一部を重ね合わせることによって、広い周波数帯域幅を実現している。
【０００７】
【発明が解決しようとする課題】しかし、上記従来のアンテナには下記の問題点がある。屋内設置用中継増幅装置のアンテナに対しては、携帯無線端末機からの電波を受信する上り回線（Up Link ）、及び携帯無線端末機への電波を送信する下り回線（Down Link ）のそれぞれに広帯域な周波数特性が必要である。しかし、図７の構成で、接地導体板２とアンテナ放射導体板１の距離を近づけた構造では、それほど広帯域にはならないという問題点を有している。また、図８，図９の構成で、広帯域な特性にするには上り回線，下り回線で合計４素子の導体板が必要であり、かなり大規模な構成になってしまい、更には給電ケーブル３、及び給電ケーブルを固定する金具がひとつのアンテナ系の２倍必要であり高価な構成になってしまうという問題点を有している。
【０００８】そこで、本発明者らは、短絡垂直平板の取付け位置を変えて放射導体板を分割するように両側に配置することにより、アンテナに二つの共振特性を持たせて帯域幅を広くした平面アンテナを提案した（特願平８－２６９０５４号参照）。
【０００９】本発明の目的は、従来技術の問題点である低姿勢の実現、低価格なアンテナ構成、及び、上記の先に提案した構成より更に広帯域なアンテナ特性の全ての条件を同時に実現するためになされたものであって、これらの条件を満たす平面アンテナを提供することにある。
【００１０】
【課題を解決するための手段】上記の目的を達成するために、先に提案した構成の短絡垂直板の長さを短くし、放射導体板の幅より短くすることにより、短絡垂直板の両側のアンテナの結合を強くし、それぞれのアンテナの反射減衰量が多くとれるようにして広帯域化を図った。すなわち、本発明の平面アンテナは、平坦な接地導体板と該接地導体板に平行な放射導体板が配置され、接地導体板と放射導体板の間には短絡垂直平板が放射導体板の中央から所定距離ずれた位置で挟持されている。短絡垂直平板は放射導体板の全幅にわたって短絡しておらず、短絡垂直平板の長さが両側縁からδだけ短いことが特徴

である。

【００１１】

【発明の実施の形態】図１は本発明の第１の実施例を示す斜視図である。図において、２は接地導体板、３は給電ケーブル、５は放射導体板、６は短絡垂直平板である。図に示したように、本発明の平面アンテナは、平板状の接地導体板２の上に平行な放射導体板５が配置され、接地導体板２と放射導体板５の間に、短絡垂直平板６が放射導体板５の中央から所定距離ずれた位置に配置され、放射導体板５と接地導体板２を短絡固定している。給電ケーブル３は、放射導体板５の短絡垂直平板６からいずれか一方の任意の距離の側端面に取付けられている。この構成において、本発明の最も特徴とするところは、短絡垂直平板６の長さであり、放射導体板５の幅より狭く、両側端面からδだけ短い点である。

【００１２】短絡垂直平板６の位置から放射導体板５の一方の端部までの長さをＡ１とし、他方の端部までの長さをＡ２とすると、短絡垂直平板６の位置はＡ１≠Ａ２になるように決められる。例えば、図１の実施例では、長さの短い方、すなわちＡ２の方に給電を行うように構成されている。

【００１３】図２は本発明の第２の実施例を示す斜視図であり、図１の第１の実施例の短絡垂直平板６の代わりに金属短絡ブロック７を用いた構成である。この第２の実施例の構成をアナログ携帯無線端末用中継増幅装置として、９００ＭＨｚ帯域用に設定したものの寸法は、以下の通りである。放射導体板５の全体の長さＬ２＝１４９mm、幅Ｗ２＝８０mm、接地導体板２からの高さＨ＝１０mm、放射導体板５の長手方向の端面から金属短絡ブロック７までの距離Ａ１＝７４mm、Ａ２＝６５mm、金属短絡ブロック７の幅Ｔ＝１０mm、放射導体板５の側端面から金属短絡ブロック７の端面までの間隔δ＝１０mm、接地導体板２の長さＬ１＝２３０mm、幅Ｗ１＝１６０mm、放射導体板５の端面から給電点までの距離Ｇ＝４０mm。

【００１４】上記寸法を有する平面アンテナの周波数特性例を図３に示す。共振周波数帯域幅（比帯域）が電圧定在波比ＶＳＷＲが２．０以下で、比帯域幅が９．０%程度と大幅に向上したことが分かる。また、両端面からの間隙δは同じ寸法である必要はなく、かつ、間隙δを任意に変えることで共振周波数、及び反射減衰量をそれぞれ変えて設定することができる。また、間隙δは両側に有する必要はなく、図４のように片側だけにしても同等の特性を示す。

【００１５】

【発明の効果】以上説明したように、本発明を実施することにより、放射導体板が１枚で複共振あるいは複同調形平面アンテナを実現することができ、短絡垂直平板６または金属短絡ブロック７の長さを放射導体板５の幅よりδ×２短くすることにより、更に帯域幅を広くすることができるので実用上極めて優れた効果がある。また、放射導体板の２枚構造に比べて、ケーブルや金具等の部品点数が半分になり、経済化を図ることができ、かつ、小形化に極めて大きい効果がある。

【図面の簡単な説明】

【図１】本発明の第１の実施例を示す広帯域複同調形平面アンテナの斜視図である。

【図２】本発明の第２の実施例を示す広帯域複同調形平面アンテナの斜視図である。

【図３】本発明の複同調形平面アンテナの反射特性例図である。

【図４】本発明の第３の実施例を示す斜視図である。

【図５】従来の単共振形板状逆Ｆアンテナの斜視図である。

【図６】従来の単共振形板状逆Ｆアンテナの反射特性例図である。

【図７】従来の複同調形平面アンテナの斜視図である。

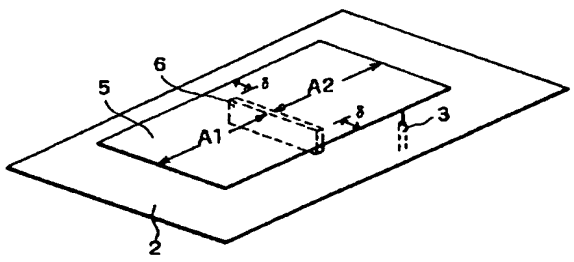
【図８】従来の複同調形平面アンテナの斜視図である。

【図９】従来の複同調形平面アンテナの斜視図である。

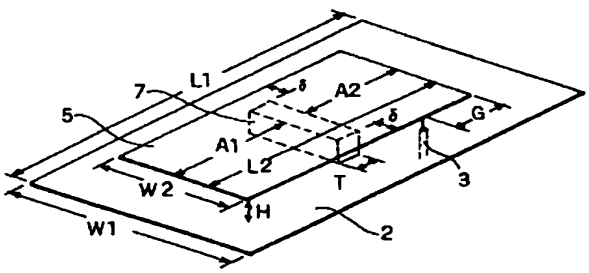
【符号の説明】

１　放射導体板
２　接地導体板
３　給電ケーブル
４　無給電導体板
５　放射導体板
６　短絡垂直平板
７　金属短絡ブロック

【図１】



【図２】



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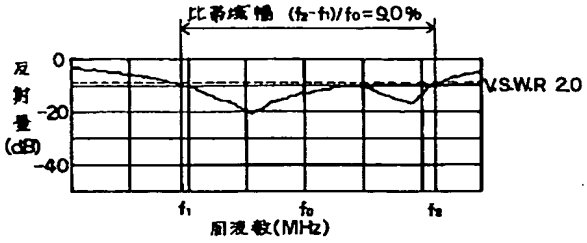

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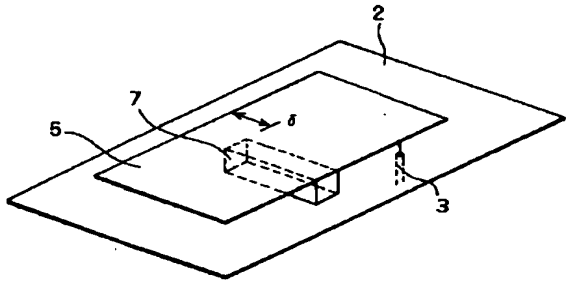

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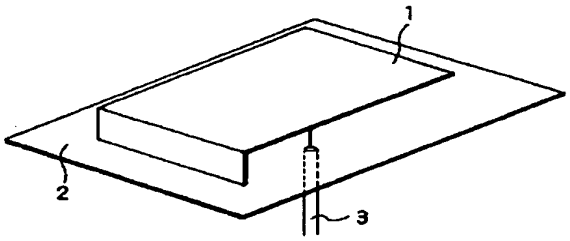
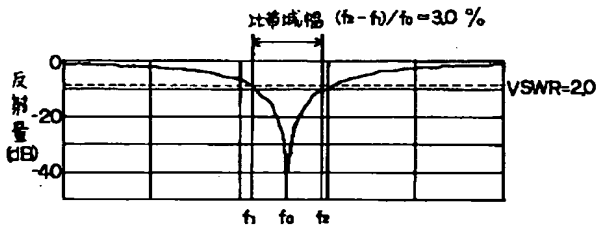
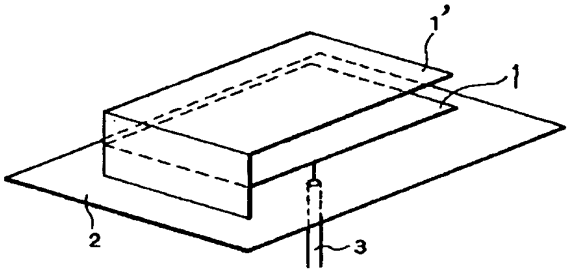


【図６】



【図７】



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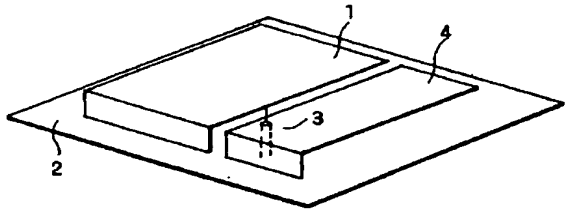
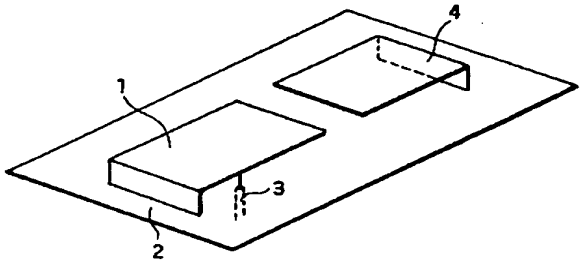


【図９】



PATENT ABSTRACTS OF JAPAN

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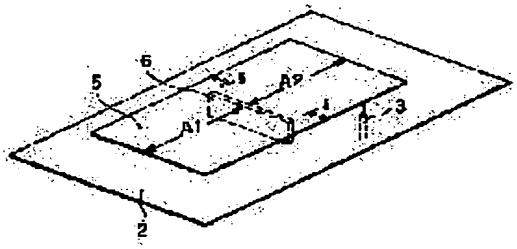
MORITA YUKIKO

(54) PLANE ANTENNA

(57)Abstract:
PROBLEM TO BE SOLVED: To widen a band width of an inverted-F plane antenna where a radiation conductor is fixed in parallel on one ground conductor with a short-circuit vertical flat plate.
SOLUTION: A radiation conductor plate 5 is provided in opposition to a grounding conductor plate 2 and a short-circuit vertical flat plate 6 for short- circuiting them is placed at a position biased from the center of the radiation conductor plate 5 wherein the length of the short-circuit vertical flat plate 6 is selected smaller than the width of the radiation conductor plate 5 by 2 × ä. Then the value of the above ä is experimentally obtained, and the frequency band width is widened by means of dual tuning resonance between two resonance frequencies, that is, a self-resonance frequency of a feeder side of the radiation conductor plate 5 and self-resonance frequency of the opposite side.



LEGAL STATUS

[Date of request for examination]

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[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

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2.**** shows the word which can not be translated.
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CLAIMS

[Claim(s)]
[Claim 1] touch-down -- a conductor -- a board and this touch-down -- a conductor -- radiation which countered a board and has been arranged in parallel -- a conductor -- with a board In a flat antenna of the shape of plate reverse F which consisted of electric supply cables which supply electric power to a position of the side edge section of a board this radiation -- a conductor -- a board and said touch-down -- a conductor -- a short circuit perpendicular plate which carries out short circuit immobilization of the board, and said radiation -- a conductor -- A board inclines toward one side from a center of the length direction, and is fixed with said short circuit perpendicular plate, and electric power is supplied from the side edge section of one of these. said radiation -- a conductor -- said short circuit perpendicular plate said radiation -- a conductor -- it constitutes from length shorter than width of face of a board -- having -- said radiation -- a conductor -- a flat antenna characterized by setting up necessary bandwidth of an antenna widely by changing a fixed position of a board, and the length of said short circuit perpendicular plate.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to amelioration of a tabular reverse F antenna especially about the flat antenna carried in a cellular-phone terminal, the small junction amplifying device installed in the interior of a room in an underground center and a building.
[0002]
[Description of the Prior Art] In recent years, a cellular phone has come to spread quickly with expansion of service areas, such as a cellular phone, low-pricing of equipment, and reduction of message cost. And although people did great numbers passing and use as a field of a life, in order to expand service of blind zones, such as an underground center which the electric wave from a base station does not reach, a department store, and office, the small junction amplifying device for the interior of a room came to be called for increasingly.
[0003] The antenna with which such a junction amplifying device for indoor installation is equipped has what used an external antenna like a dipole antenna, and the thing which used an internal antenna which does not spoil an indoor fine sight. The flat antenna to which the internal antenna attached in the case of equipment is generally called a tabular reverse F antenna is used. This antenna is also called the microstrip form reverse F antenna.
[0004] Drawing 5 is the perspective diagram showing the structure of the conventional reverse F form flat antenna. this conventional flat antenna -- touch-down -- a conductor -- a board 2 and radiation -- a conductor -- a board 1 and in order to take adjustment -- radiation -- a conductor -- it is the single resonance or the single alignment tabular reverse F antenna which consisted of electric supply cables 3 which supply electric power as the feeding point in the point of having separated only a predetermined distance from the location of the short stub (short circuit perpendicular plate) which the board 1 bent. Drawing 6 is the example Fig. of a reflection property of the conventional reverse F form flat antenna shown in drawing 5 , and the comparison bandwidth which the amount of reflection can use by -10dB or less with which a predetermined voltage standing wave ratio (VSWR) is satisfied of two or less is 3.0%.
[0005] However, for a certain reason, the transceiver delta frequency of the cellular-phone system of a 850MHz band has about 45MHz (about 5.3%) of problems in carrying out transceiver common use of the above-mentioned antenna by one piece, for example.
[0006] Various works have been carried out that the problem of this fractional band width should be solved until now. for example, it is shown in drawing 7 -- as -- radiation -- a conductor -- no supplying [from which not only the board 1 but resonance frequency differs slightly] electric power -- a conductor -- it is shown in what accumulated board 1' and was made into two steps, and drawing 8 and drawing 9 -- as -- radiation -- a conductor -- the place where distance got used a little from the board 1 -- parallel -- or -- countering -- no supplying electric power -- a conductor -- there are some which put the board 4 in order. these -- antenna radiation -- a conductor -- a board 1 and no supplying electric power -- a conductor -- a board 4 joins together -- both conductors -- the board is functioning as a radiating element and large frequency bandwidth is realized by piling up a part of each resonance frequency band.

[0007]
[Problem(s) to be Solved by the Invention] However, there is the following trouble in the above-mentioned conventional antenna. The broadband frequency characteristic is required for each of the going-up circuit (Up Link) which receives the electric wave from a walkie-talkie terminal to the antenna of the junction amplifying device for inside-of-a-house installation, and the going-down circuit (Down Link) which transmits the electric wave to a walkie-talkie terminal. however, the configuration of drawing 7 -- touch-down -- a conductor -- a board 2 and antenna radiation -- a conductor -- with the structure which brought the distance of a board 1 close, it has so much the trouble of not becoming, in the broadband. moreover, a property [broadband / in the configuration of drawing 8 and drawing 9] -- carrying out -- an uphill circuit -- getting down -- a circuit -- a total of four conductors -- the metallic ornaments which a board is required, become a quite large-scale configuration, and fix the electric supply cable 3 and an electric supply cable further -- 2 of one antenna system -- double -- it has the trouble of becoming a required and expensive configuration.
[0008] then, this invention persons -- the fitting location of a short circuit perpendicular plate -- changing -- radiation -- a conductor -- the flat antenna which gave the two resonance characteristics to the antenna and made bandwidth large was proposed by arranging on both sides so that a board may be divided (refer to Japanese Patent Application No. No. 269054 [eight to]).
[0009] The purpose of this invention is to offer [to be made in order to realize all the conditions of a still broadband antenna property to coincidence from implementation of the low profile which is the trouble of the conventional technology, a low price antenna configuration, and the configuration proposed at the above-mentioned point, and] the flat antenna which fulfills these conditions.
[0010]
[Means for Solving the Problem] the length of a short circuit vertical panel of a configuration of having proposed previously, in order to attain the above-mentioned purpose -- short -- carrying out -- radiation -- a conductor -- by making it shorter than width of face of a board, as association of an antenna of both sides of a short circuit vertical panel was strengthened and many return loss of each antenna could be taken, broadband-ization was attained. namely, touch-down with a flat flat antenna of this invention -- a conductor -- a board and this touch-down -- a conductor -- radiation parallel to a board -- a conductor -- a board arranges -- having -- touch-down -- a conductor -- a board and radiation -- a conductor -- between boards -- a short circuit perpendicular plate -- radiation -- a conductor -- it is pinched by predetermined distance gap ****** from a center of a board. a short circuit perpendicular plate -- radiation -- a conductor -- it does not connect too hastily covering full [of a board], but it is the feature that the length of delta of a short circuit perpendicular plate is short from edges on both sides.
[0011]
[Embodiment of the Invention] Drawing 1 is the perspective diagram showing the 1st example of this invention. drawing -- setting -- 2 -- touch-down -- a conductor -- a board and 3 -- an electric supply cable and 5 -- radiation -- a conductor -- a board and 6 are short circuit perpendicular plates. it was shown in drawing -- as -- the flat antenna of this invention -- plate-like touch-down -- a conductor -- radiation parallel on a board 2 -- a conductor -- a board 5 arranges -- having -- touch-down -- a conductor -- a board 2 and radiation -- a conductor -- between boards 5 -- the short circuit perpendicular plate 6 -- radiation -- a conductor -- it arranges from the center of a board 5 to predetermined distance gap ****** -- having -- radiation -- a conductor -- a board 5 and touch-down -- a conductor -- short circuit immobilization of the the electric supply cable 3 -- radiation -- a conductor -- it is attached in the side edge side of the distance of one of arbitration from the short circuit perpendicular plate 6 of a board 5. this configuration -- setting -- the place of this invention by which it is characterized most -- the length of the short circuit perpendicular plate 6 -- it is -- radiation -- a conductor -- it is narrower than the width of face of a board 5, and only delta is a short point from a both-sides end face.

[0012] the radiation from the location of the short circuit perpendicular plate 6 -- a conductor -- if length to one edge of a board 5 is set to A1 and length to the other-end section is set to A2, it will be decided by the location of the short circuit perpendicular plate 6 that it is set to A1 ! =A2. For example, it consists of examples of drawing 1 so that electric power may be supplied to the one where length is shorter, i.e., the direction of A2.
[0013] Drawing 2 is the perspective diagram showing the 2nd example of this invention, and is the configuration of having used the metal short circuit block 7 instead of the short circuit perpendicular plate 6 of the 1st example of drawing 1 . The size is as follows although set to 900MHz bands by using the configuration of this 2nd example as the junction amplifying device for analog walkie-talkie terminals. radiation -- a conductor -- length [of the whole board 5] L -- 2= 149mm, width-of-face W2=80mm, and touch-down -- a conductor -- a height of H= 10mm from a board 2 radiation -- a conductor -- the distance A from the end face of the longitudinal direction of a board 5 to the metal short circuit block 7 -- 1= 74mm width of face of T= 10mm of A2=65mm and the metal short circuit block 7, and radiation -- a conductor -- the gap of delta= 10mm from the side edge side of a board 5 to the end face of the metal short circuit block 7, and touch-down -- a conductor -- length [of a board 2] L -- 1= 230mm, width-of-face W1=160mm, and radiation -- a conductor -- the distance of G= 40mm from the end face of a board 5 to the feeding point
[0014] The example of the frequency characteristic of the flat antenna which has the above-mentioned size is shown in drawing 3 . It turns out that the voltage standing wave ratio VSWR of resonance frequency bandwidth (fractional bandwidth) improved or less by 2.0 as sharply [fractional band width] as about 9.0%. Moreover, the gap delta from a both-ends side does not need to be the same size, and by changing Gap delta into arbitration, resonance frequency and return loss can be changed, respectively, and can be set up. Moreover, it is not necessary to have Gap delta on both sides, and it shows a property equivalent only as for one side like drawing 4 .
[0015]
[Effect of the Invention] carrying out this invention, as explained above -- radiation -- a conductor -- a board -- one sheet -- double resonance or a double alignment form flat antenna -- being realizable -- the length of the short circuit perpendicular plate 6 or the metal short circuit block 7 -- radiation -- a conductor -- the width of face of a board 5 -- deltax2 -- by shortening, since bandwidth can be further made large, there is an effect which was extremely excellent practically. moreover, radiation -- a conductor -- compared with the two-sheet structure of a board, components mark, such as a cable metallurgy implement, become half, economization can be attained and a very large effect is in a miniaturization.

[Translation done.]

* NOTICES *

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3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective diagram of a broadband double alignment form flat antenna showing the 1st example of this invention.
[Drawing 2] It is the perspective diagram of a broadband double alignment form flat antenna showing the 2nd example of this invention.
[Drawing 3] It is the example Fig. of a reflection property of the double alignment form flat antenna of this invention.
[Drawing 4] It is the perspective diagram showing the 3rd example of this invention.
[Drawing 5] It is the perspective diagram of the conventional single resonance form tabular reverse F antenna.
[Drawing 6] It is the example Fig. of a reflection property of the conventional single resonance form tabular reverse F antenna.
[Drawing 7] It is the perspective diagram of the conventional double alignment form flat antenna.
[Drawing 8] It is the perspective diagram of the conventional double alignment form flat antenna.
[Drawing 9] It is the perspective diagram of the conventional double alignment form flat antenna.
[Description of Notations]
1 Radiation -- Conductor -- Board
2 Touch-down -- Conductor -- Board
3 Electric Supply Cable
4 Unpaid Conductor Board
5 Radiation -- Conductor -- Board
6 Short Circuit Perpendicular Plate
7 Metal Short Circuit Block

[Translation done.]

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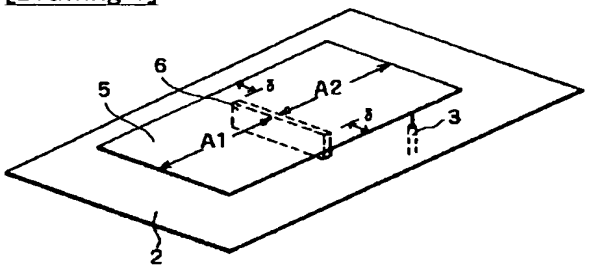
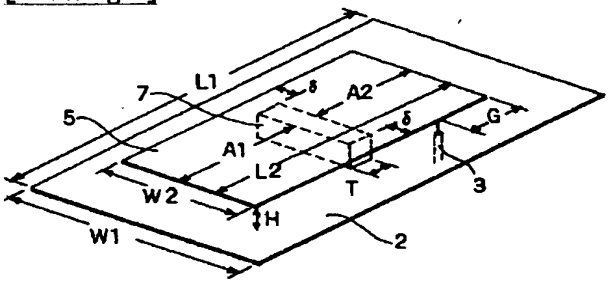
DRAWINGS

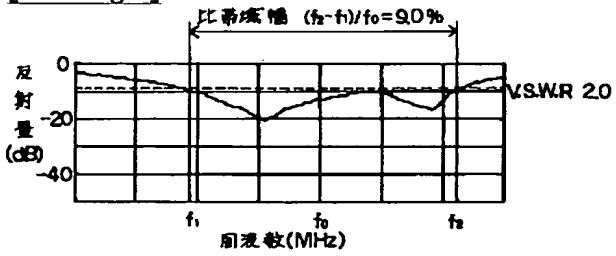
[Drawing 1]



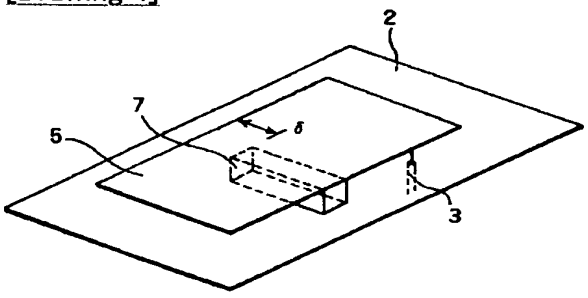
[Drawing 2]



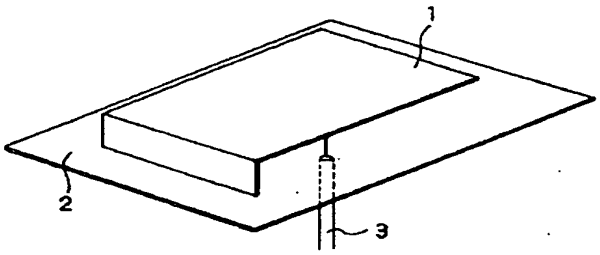
[Drawing 3]



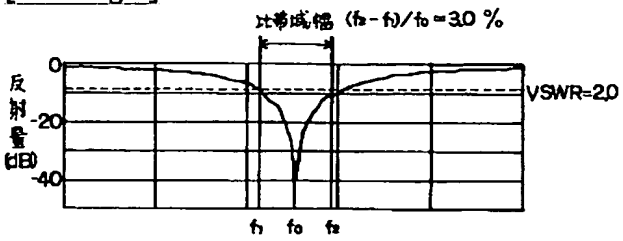
[Drawing 4]



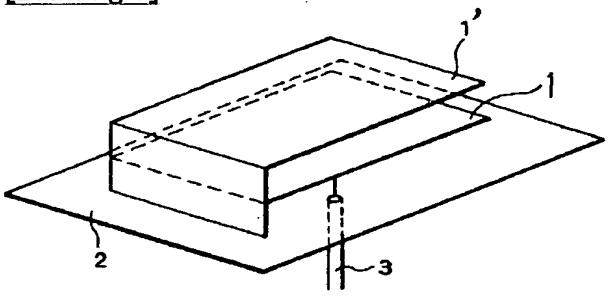
[Drawing 5]



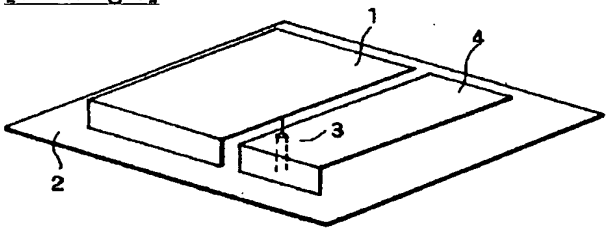
[Drawing 6]



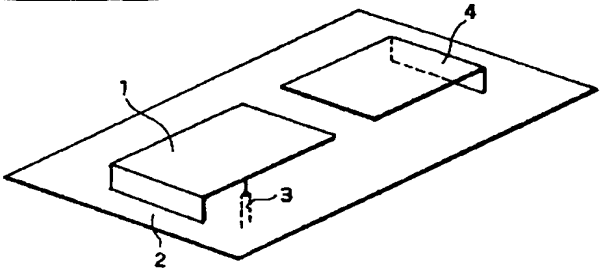
[Drawing 7]



[Drawing 8]



[Drawing 9]



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